

TITLE OF THE INVENTION
INFORMATION DISPLAY APPARATUS, INFORMATION DISPLAY
METHOD AND PROGRAM THEREFOR

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This application is based upon and claims the
benefit of priority from prior Japanese Patent
Application No. 2003-095402, filed March 31, 2003, the
entire contents of which are incorporated herein by
reference.

10 BACKGROUND OF THE INVENTION

1. Field of the Invention

 The present invention relates to an information
display apparatus which is incorporated in or connected
to a video playback apparatus or video recorder/player
15 apparatus represented by a television receiver, DVD
apparatus, or hard disk video recorder and provides a
closed caption display function, an information display
method, and a program.

2. Description of the Related Art

20 Television broadcasts and DVD video contents
provide closed caption information that supplements
speech information. In a television broadcast,
teletext signals are superposed on video signals. More
specifically, character information is transmitted
25 using an identification signal (VBI signal) inserted
during a vertical blanking period (see, e.g., Japanese
Patent Laid-Open No. 9-65295). DVDs and the like are

so designed as to record multilingual closed caption information together with images and speech. Digital high-definition television broadcasts can also transmit closed captions as sub-video information.

5 The use of closed caption character information is effective not only for a hearing impaired person and deaf person but also for a normal listener when it is hard to hear speech corresponding to an image (for example, when the playback sound volume is small or
10 ambient noise is large). This is also effective when it is difficult to play back speech corresponding to an image so as to be able to hear it (for example, in high speed playback such as fast-forward playback while displaying an image, slow-motion replay, pause,
15 backward playback, or multi-screen display).

 However, a conventional video playback apparatus or information display apparatus does not provide closed caption character information display functions corresponding to viewing situations. A technique of
20 displaying a closed caption in a mute state has also been known (see, e.g., Japanese Patent Laid-Open No. 7-46500). No conventional video playback apparatus or information display apparatus provides a function of controlling display of closed caption character
25 information in accordance with the viewing situation.

 It is an object of the present invention to provide an information display apparatus capable of

controlling display of closed caption character
information in accordance with a viewing situation, and
an information display method therefor. In playing
back an image by a television receiver, video playback
5 apparatus, video recorder/player apparatus, or the
like, or playing back speech by a speech playback
apparatus, speech recorder/player apparatus, or the
like, closed caption character information is displayed
or the display form is changed in accordance with the
10 speech playback status to appropriately supplement
speech information in, e.g., a situation in which it is
probably impossible or hard to hear or understand
speech.

BRIEF SUMMARY OF THE INVENTION

15 According to an aspect of the present invention,
there is provided an information display apparatus
comprising: a display device configured to display
a video; a speech detection unit configured to detect
a playback state of a playback speech; a closed caption
20 display unit configured to generate character
information associated with the playback speech and
display it on the display device together with the
video; and a closed caption display unit configured to
carry out a changing control for changing according to
25 the detected playback state a display state of
the character information that is displayed on the
display device by the closed caption display unit.

According to another aspect of the present invention, there is provided an information display method comprising: generating a playback speech; detecting a playback state of the playback speech; and
5 changing a display state of character information associated with the playback speech according to the detected playback state.

According to another aspect of the present invention, there is provided a program stored in
10 a computer readable medium for displaying character information on a display device, comprising: means for instructing a computer to playback a video and a speech from a recording medium; means for instructing the computer to change a playback state of the video and
15 the speech; means for instructing the computer to display character information associated with the video and the speech; and means for instructing the computer to change a display state of the character information according to the display state of the video and the
20 speech.

According to the present invention, when an image is played back by a television receiver, video playback apparatus, video recorder/player apparatus, or the like, or speech is played back by a speech playback
25 apparatus, speech recorder/player apparatus, or the like. Closed caption character information is displayed or the display form is changed in accordance

with the speech playback status to appropriately supplement speech information in, e.g., a situation in which it is probably impossible or difficult to hear or understand speech. In this manner, display of closed caption character information can be controlled in accordance with the viewing situation. For example, when speech does not satisfy conditions which are set in advance as a state in which the speech can be properly heard, closed caption information which supplements the speech information can be properly displayed, or the display form can be appropriately changed.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is a block diagram of an information display apparatus according to the first embodiment of the present invention;

FIG. 2 is a diagram showing an example of a process rule in a closed caption display controller of the embodiment;

FIGS. 3A to 3D are diagrams showing an example of control of a closed captions display in the embodiment;

FIG. 4 is a diagram showing another example of control of a closed caption display in the embodiment;

FIG. 5 is a block diagram of an information display apparatus according to the second embodiment of the present invention;

FIG. 6 is a diagram showing an example of

a process rule in a closed caption display control unit of the embodiment;

FIG. 7 is a diagram showing an example of display on the screen in the embodiment;

5 FIG. 8 is a flow chart showing an example of a flow of a process in a closed caption display control unit of the embodiment;

FIG. 9 is a flow chart showing an example of a flow of a detailed process in step S1 of FIG. 8;

10 FIG. 10 is a diagram showing an example of a closed caption display method at the time of a reverse playback in the embodiment;

FIG. 11 is a block diagram of an information display apparatus according to the third embodiment of
15 the present invention;

FIG. 12 is a block diagram of an information display apparatus according to the fourth embodiment of
the present invention; and

FIG. 13 is a diagram showing an example of
20 division display of a screen in the embodiment.

DETAILED DESCRIPTION OF THE INVENTION

Preferred embodiments of the present invention will be described in detail below with reference to the several views of the accompanying drawing.

25 (First Embodiment)

An information display apparatus according to the first embodiment of the present invention is used while

being connected to an apparatus that receives information such as a broadcast containing video data, speech data, and closed caption character information data. Closed caption character information may be
5 given as data separated from an image and speech, superposed in a video signal and transmitted, or received as a sub-image.

FIG. 1 shows an example of the arrangement of the information display apparatus according to the first
10 embodiment.

As shown in FIG. 1, the information display apparatus according to the first embodiment comprises a speech input unit 11 which inputs a speech signal, a speech playback state detector 12 which processes
15 an input speech signal and detects a speech output state, a speech output unit 13 which outputs an input speech signal, an ambient noise detector 14 which detects an ambient noise level, a video input unit 21 which inputs a video signal, a character information
20 input unit 27 which inputs closed caption character information, a closed caption display controller 23 which controls display of input closed caption character information, a closed caption video generator 24 which generates a video signal displaying a closed
25 caption on the basis of an input video signal, input closed caption character information, and character font data, and a video output unit 25 which outputs

a video signal generated by the closed caption video generator 24. The character information input unit 27 may be input the closed caption character information corresponding a speech by key-in or conventional speech recognition. When no closed caption is displayed, the closed caption video generator 24 outputs a video signal without displaying any closed caption. Character font data may also be installed in the closed caption video generator 24.

The speech playback state detector 12 monitors the sound volume of a speech signal input to the speech input unit 11. The sound volume can be monitored depending on the maximum power per a given time or the like. The speech playback state detector 12 can also be configured to detect whether the sound volume of a speech signal is 0.

The ambient noise detector 14 receives ambient noise via a microphone, and detects the loudness of noise. The microphone is so arranged as not to be influenced by a speech output from the speech output unit 13, or as to estimate any ambient sound other than playback speech by referring to a speech signal input to the speech input unit 11. A microphone may detect noise at the viewer position with directivity.

In accordance with the sound volume of a speech signal detected by the speech playback state detector 12 and the loudness of ambient noise detected by the

ambient noise detector 14, the closed caption display controller 23 controls the closed caption video generator 24 by selecting the show or hide state of a closed caption in accordance with at least one of
5 three rules shown in FIG. 2:

"Rule 1: display a closed caption when the speech signal is silent or it is in less than a given level"

"Rule 2: display a closed caption when the speech signal is in less than a reference level determined in
10 accordance with the ambient noise level"

"Rule 3: display a closed caption when the ambient noise level is in not less than the given level"

If two or more of these rules are used, the hide state is selected only when the situation doe not
15 correspond to all of the rules. When even one rule corresponds to the situation, the display state is selected.

As a sequence of determining whether each rule corresponds to the situation, for example, rules are
20 extracted one by one to check whether the rule corresponds to the situation. When at first the rule corresponding to the situation is found, the display state is selected to end the sequence. When the rule corresponding to the situation cannot be found upon
25 checking all of the rules, the hide state is selected to end the sequence.

In the above example, according to the rules 1

and 2, a closed caption is properly displayed in
correspondence with the level of difficulty in hearing
due to a weak speech signal. When these processes are
not executed, the speech playback state detector 12 can
5 be omitted. In the absence of the speech playback
state detector 12, the speech input unit 11 is directly
connected to the speech output unit 13.

According to the rules 2 and 3, a closed caption
is appropriately displayed in correspondence with the
10 difficulty in hearing due to an ambient noise. When
these processes are not executed, the ambient noise
detector 14 can be omitted.

For example, when the sound volume is turned down
on the television tuner side, it is hard to hear and
15 understand the contents of a talk though a laughing
voice or the like can be heard. Also, when ambient
noise becomes loud, e.g., the telephone starts ringing,
it becomes difficult to hear the television speech.
However, the television speech can be heard even in
20 a noisy environment by turning up the sound volume of
the television.

The first embodiment automatically displays
a closed caption in such situation in which it is hard
to hear speech, allowing the viewer to understand the
25 contents. FIG. 3A illustrates a state in which the
no-closed caption display state automatically changes
to the closed caption display state.

The reference level and the parameters of the function are preferably set for each viewer who watches a program. For example, an elderly viewer may set the reference level of the speech signal slightly higher than that for a young viewer. For a viewer who watches a program using a headphone or earphone, the reference level of ambient noise may be set high or the influence of ambient noise on each reference level may be reduced.

In general, information supplementation by a closed caption is not so necessary for a normal listener. Even in the closed caption display state, the character size is set smaller than a normal one. The character size may be changed to a normal one in accordance with the closed caption display control condition, as shown in FIG. 3B, or set larger than a normal one, as shown in FIG. 3C. The number of lines may also be increased, as shown in FIG. 3D.

Subtitle display control depending on the speech condition is not effective for a hearing impaired person. Thus, a mode in which a closed caption is displayed is always set selectable in accordance with the viewer.

The difficulty in hearing may be evaluated in several stages by setting a plurality of reference levels for each condition. The degrees of difficulty in hearing may be made to correspond to respective

operations by using the maximum value of a difficulty value, as shown in FIG. 4.

5 The information display apparatus according to the first embodiment can be so connected as to process an input from a television tuner on the input stage of an amplifier or the like which controls the sound volume. Also, the information display apparatus can be so connected as to process an output signal having undergone sound volume control by the amplifier or the like, or a signal for driving the loudspeaker. In this case, the sound volume control state is reflected, and actual difficulty in hearing a speech can be further reflected.

15 The rules 1 to 3 can be given by other equivalent expressions. For example, the rule 3 may be expressed by "display a closed caption when the ambient noise level is not in less than the given level". This also applies to the remaining rules.

20 The rules 1 to 3 define conditions to display a closed caption. A closed caption is displayed when even one of the conditions is satisfied, and is not displayed when no condition is satisfied. To the contrary, the rules may define conditions not to display a closed caption. A closed caption is not displayed when all the conditions are satisfied, and is displayed when even one condition is not satisfied. These rules and functions are merely an example, and

can be variously changed. All (or some) of the above-mentioned functions may be adopted to allow the viewer to arbitrary set which of the functions is to be used.

5 (Second Embodiment)

An information display apparatus according to the second embodiment of the present invention is realized by assembling it in an apparatus which reads out and plays back data from a recording medium such as
10 a DVD that records video data, speech data, and closed caption character information data.

FIG. 5 shows an example of the arrangement of the information display apparatus according to the second embodiment.

15 As shown in FIG. 5, the information display apparatus according to the second embodiment comprises a recording medium 31 which records video data, speech
data, and closed caption character information data, a playback controller 32 which controls read and
20 playback of the recording medium, a speech playback unit 33 which reads out speech data from the recording medium 31, a speech playback state detector 12 which processes speech data and detects a speech output state, a speech output unit 13 which outputs speech
25 data as a speech signal, an ambient noise detector 14 which detects an ambient noise level, a video playback unit 34 which reads out video data from the recording

medium 31, a closed caption playback unit 35 which
reads out closed caption character information data
from the recording medium 31, a closed caption display
controller 23 which controls display of read closed
5 caption character information data, a closed caption
video generator 24 which generates a video signal
displaying a closed caption on the basis of read video
data, read closed caption character information data,
and character font data, and a video output unit 25
10 which outputs a generated video signal with
superimposed closed caption.

The speech playback state detector 12, speech
output unit 13, ambient noise detector 14, closed
caption video generator 24, and video output unit 25
15 are basically the same as those in the first
embodiment.

The playback controller 32 controls the playback
state and playback sound volume in accordance with
viewer operation via an operation panel, remote
20 controller, or the like. The playback controller 32
reads out, plays back, and outputs video information,
speech information, and closed caption information.

In accordance with the sound volume of a speech
signal detected by the speech playback state detector
25 12, the loudness of ambient noise detected by the
ambient noise detector 14, and the playback state and
playback sound volume of the playback controller 32,

the closed caption display controller 23 controls the closed caption video generator 24 by selecting the show or hide state of a closed caption in accordance with at least one of nine rules shown in FIG. 6:

5 "Rule 1: display a closed caption when the speech signal is silent or is in less than a given level"

 "Rule 2: display a closed caption when the speech signal is in less than a reference level determined in accordance with the ambient noise level"

10 "Rule 3: display a closed caption when the ambient noise level is in not less than the given level"

 "Rule 4: display a closed caption when the playback state is forward playback other than real-time playback"

15 "Rule 5: display a closed caption when the playback state is backward playback"

 "Rule 6: display a closed caption when the playback state is pause"

20 "Rule 7: display a closed caption when the playback sound volume is muted (sound deadening) or is in less than a given level"

 "Rule 8: display a closed caption when the playback sound volume is in less than a reference level determined in accordance with the ambient noise level"

25 "Rule 9: display a closed caption when the playback state is a state in which a speech channel other than the main speech is output"

If a plurality of rules are utilized, the hide state is selected when all the rules result in the hide state.

When the rules 2, 3, and 8 are not adopted, the ambient noise detector 14 can be omitted. When the
5 rules 1 and 2 are not applied, the speech playback state detector 12 can be omitted.

Instead of applying the rules 4 to 6 to selection of the closed caption display state in the closed caption display controller 23, the playback speech may
10 be muted (sound deadening) in the closed caption display controller 23 when any of these three rules is satisfied. In this case, the speech playback state detector 12 detects that the playback speech does not generate any sound, and the rule 1 is applied,
15 obtaining the same effects.

A rule "display a closed caption in a playback state other than forward real-time playback" may be
employed in place of the rules 4 to 6. For example, the rule 4 can display a closed caption as shown in
20 FIG. 7 during fast-forward playback at a five-fold speed.

For example, when the sound volume of DVD video is turned down, it is difficult to hear and understand the contents of a talk though a laughing voice or the like
25 can be heard. Also, when ambient noise becomes loud, e.g., the telephone starts ringing, it becomes difficult to hear the speech of DVD video. However,

the speech of the DVD video can be heard even in
a noisy environment by turning up the playback sound
volume. The sound volume may be determined from
a speech signal, or control information of the DVD
5 video apparatus.

In special playback such as two-fold-speed
playback, it is difficult to play back speech so as
to easily hear it. If the time axis is directly
shortened, the speech pitch changes. Even use of
10 a speech speed conversion technique of
prolonging/shortening the time without changing the
pitch, prolongation/shortening by about 50% or more
makes hearing difficult. Prolongation/shortening by
about 20% hardly makes hearing difficult, and even
15 special playback can be regarded as real-time playback.
From this, a condition to determine "not real-time
playback" in the rule 4 may be defined as, for example,
"playback with speech at a speed of 0.8 fold or less or
1.2 fold or more".

20 Generally in backward (rewind) playback, speech
cannot be discerned even by real-time playback.
In general playback control, the speech synchronized
with an image cannot be output during a pause.

When a plurality of speech channels such as
25 a bilingual multiplex broadcast are provided, one
speech channel such as main speech or sub-speech is
selected and output. When the sub-speech is selected,

no main speech is output, and thus a closed caption often corresponding to the main speech is preferably displayed. Also when the main speech and sub-speech are assigned to, e.g., left and right channels and
5 simultaneously output, the main speech is hard to heard, and its closed caption is preferably displayed.

When the language is designated to select a speech channel, the viewer can easily understand his/her native language, but may find it difficult to
10 understand another language. In this case, a closed caption corresponding to the language of the speech is desirably displayed. Alternatively, the viewer's native language is selected and set, and when a speech channel other than the native language is selected, the
15 closed caption of the viewer's native language is preferably displayed.

According to the second embodiment, a closed caption can be automatically displayed in such situation in which it is hard to hear speech, allowing
20 the viewer to understand the contents.

The processing flow in the closed caption display controller 23 will be explained with reference to the flow chart of FIG. 8.

The sound volume of a speech signal detected in
25 the speech playback state detector 12 is evaluated (rules 1 and 2), and a closed caption display operation mode is set (step S1). The loudness of ambient noise

detected in the ambient noise detector 14 is evaluated (rule 3), and a closed caption display operation mode is set (step S2). Of playback states held in the playback controller 32, the playback speed is evaluated (rules 4 to 6), and a closed caption display operation mode is set (step S3). The playback sound volume held in the playback controller 32 is evaluated (rules 7 and 8), and a closed caption display operation mode is set (step S4).

A speech channel to be selected out of multiple speech channels held in the playback controller 32 is evaluated (rule 9), and a closed caption display operation mode is set (step S5). The closed caption display state is determined in accordance with a mode in which it is hardest to hear speech, out of the closed caption display operation modes in the respective steps, and closed caption display is controlled (step S6).

A detailed processing flow in step S1 will be described with reference to the flow chart of FIG. 9.

A speech signal level A1 is compared with the first reference level A10 set in advance (step S11). If A1 is lower, A1 is compared with the second reference level A11 set in advance (step S12). If A1 is lower, (rule 1) closed caption display operation mode 2 is set (step S17). If A1 is higher than or equal to A11 in step S12, (rule 1) closed caption

display operation mode 1 is set (step S16).

A reference level F_{ln} (A_n) determined in accordance with loudness A_n of ambient noise is calculated (step S13), and compared with the speech
5 signal level A_1 (step S14). If A_1 is lower, (rule 2) closed caption display operation mode 1 is set (step S16). If no condition is satisfied, closed caption display operation mode 0 is set (step S15).

A closed caption display method in backward
10 playback will be explained with reference to an example in FIG. 10.

In this example, pieces of video information of frames F_1 to F_{11} , and pieces of speech information synchronized in time are provided. "In sync with
15 image" is added to or embedded in the frame F_2 .

"Subtitle is displayed" is added to or superposed in the frame F_6 . Subtitle information "delete closed caption" is added to or superposed in the frame F_{10} .

In forward playback, frames are sequentially
20 played back from the frames F_1 to F_{11} . The closed caption "in sync with image" is displayed from F_2 to F_5 , and the closed caption "closed caption is displayed" is displayed from the frames F_6 to F_9 . In backward playback, the frames are played back in the
25 reverse order from the frames F_{11} to F_1 . The frames are searched in the reverse order from the frame F_{11} for a frame containing closed caption information.

If closed caption deletion information is found in the frame F10, the frames F11 and F10 are displayed without any closed caption. The frames are searched in the reverse order from the frame F9 for a frame containing closed caption information. If closed caption information "closed caption is displayed" is found in the frame F6, the frames F9, F8, F7, and F6 are displayed with the closed caption "closed caption is displayed".

The frames are searched in the reverse order from the frame F5 for a frame containing closed caption information. If closed caption information "in sync with image" is found in the frame F2, the frames F5, F4, F3, and F2 are displayed with the closed caption "in sync with image". No preceding frame containing closed caption information exists before the frame F1, thus the closed caption is deleted, and the frame F1 is displayed.

The rules 1 to 9 can be represented by other equivalent expressions. For example, the rule 5 may be expressed by "display a closed caption when the playback state is not forward playback, pause, or stop". This also applies to the remaining rules.

The rules 1 to 9 define conditions to display a closed caption. A closed caption is displayed when even one of the conditions is satisfied, and is not displayed when no condition is satisfied. To the

contrary, the rules may define conditions not to display a closed caption. A closed caption is not displayed when all the conditions are satisfied, and is displayed when even one condition is not satisfied.

5 These rules and functions are merely an example, and can be variously changed. All (or some) of the above-mentioned functions may be employed to allow the viewer to arbitrary set which of the functions is to be used.

10 (Third Embodiment)

 An information display apparatus according to the third embodiment of the present invention is used while being connected to an apparatus which reads out and plays back data from a recording medium such as a DVD
15 recording video data, speech data, and closed caption character information data. Subtitle character information may be given as data different from
 an image and speech, or superposed in a video signal and recorded.

20 FIG. 11 shows an example of the arrangement of the information display apparatus according to the third embodiment. As shown in FIG. 11, the information display apparatus according to the third embodiment
 comprises a speech input unit 11 which inputs a speech
25 signal, a speech playback state detector 12 which processes an input speech signal and detects a speech output state, a speech output unit 13 which outputs

an input speech signal, an ambient noise detector 14 which detects an ambient noise level, a control information input unit 26 which inputs playback control information of an image or the like, a video input unit 21 which inputs a video signal, a character information input unit 27 which inputs closed caption character information, a closed caption display controller 23 which controls display of input closed caption character information, a closed caption video generator 24 which generates a video signal displaying a closed caption on the basis of an input video signal, input closed caption character information, and character font data, and a video output unit 25 which outputs a generated video signal of a closed caption.

The speech input unit 11, speech playback state detector 12, speech output unit 13, ambient noise detector 14, video input unit 21, character information input unit 27, closed caption video generator 24, and video output unit 25 are basically the same as those in the first and second embodiments.

The control information input unit 26 inputs playback state information and playback sound volume information which are controlled in accordance with viewer operation via an operation panel, a remote controller, or the like in an apparatus which plays back an image or the like from a recording medium.

In accordance with the sound volume of a speech

signal detected by the speech playback state detector
12, the loudness of ambient noise detected by the
ambient noise detector 14, and playback state
information and playback sound volume information which
5 are input to the control information input unit 26,
the closed caption display controller 23 controls
the closed caption video generator 24 by selecting
the show or hide state of a closed caption in
accordance with, e.g., at least one of the nine rules
10 described in the second embodiment. If a plurality of
rules are utilized, the hide state is selected when all
the rules exhibit the hide state.

The information display apparatus according to
the third embodiment can be so configured as to
15 receive information on the operation state of a DVD
recorder/player apparatus or the like and input the
information to the control information input unit 26.
The information display apparatus may receive a remote
control signal (infrared signal, radio signal, or the
20 like) for operating the DVD recorder/player apparatus
or the like, and then operate.

The information display apparatus according to the
third embodiment can be so connected as to process
an input from the DVD recorder/player apparatus or
25 the like on the input stage of an amplifier or the like
which controls the sound volume. Also, the information
display apparatus can be so connected as to process

an output signal having undergone sound volume control
by the amplifier or the like, or a signal for driving
the loudspeaker. In this case, the sound volume
control state is reflected, and actual difficulty in
5 hearing speech can be further reflected.

The above-described rules and functions are merely
an example, and can be variously changed. All (or
some) of the functions may be adopted to allow the
viewer to arbitrary set which of the functions is to be
10 used.

(Fourth Embodiment)

An information display apparatus according to the
fourth embodiment of the present invention is realized
by assembling it in an apparatus which receives
15 information of a broadcast or the like containing video
data, speech data, and closed caption character
information data. Subtitle character information may
be given as data different from an image and speech,
superposed in a video signal and transmitted, or
20 received as a sub-image.

FIG. 12 shows an example of the arrangement of the
information display apparatus according to the fourth
embodiment. As shown in FIG. 12, the information
display apparatus according to the fourth embodiment
25 comprises a contents receiver 41 which receives
contents of a broadcast or the like transmitted via
radio waves, a cable, or the like, a speech playback

unit 43 which extracts speech data from received
information, a speech playback state detector 12 which
processes an extracted speech signal and detects
a speech output state, a speech output unit 13 which
5 outputs an extracted speech signal, an ambient noise
detector 14 which detects an ambient noise level,
a video playback unit 44 which extracts video data from
received information, a closed caption playback unit 45
which extracts closed caption character information
10 data from received information, a closed caption
display controller 23 which controls display of
extracted closed caption character information,
a closed caption video generator 24 which generates
a video signal displaying a closed caption on the basis
15 of an extracted video signal, input closed caption
character information, and character font data, and
a video output unit 25 which outputs a generated video
signal of a closed caption.

The speech playback state detector 12, speech
20 output unit 13, ambient noise detector 14, closed
caption video generator 24, and video output unit 25
are basically the same as those in the first, second,
and third embodiments. The playback controller 42
controls the playback state and playback sound volume
25 in accordance with viewer operation via an operation
panel, remote controller, or the like. The playback
controller 42 reads out, plays back, and outputs video

information, speech information, and closed caption information.

When the information display apparatus is equipped with a function of receiving contents transmitted via a plurality of channels in parallel with each other, 5 splitting the screen into, for example, four screen sections as shown in FIG. 13, and displaying the contents, the playback controller 42 also controls the screen display state in accordance with viewer 10 operation. The playback controller 42 further controls to select one of contents on the display windows and play back a speech.

In accordance with the sound volume of a speech signal detected by the speech playback state detector 12, the loudness of ambient noise detected by the 15 ambient noise detector 14, and the playback state, playback sound volume, and screen split state of the playback controller 42, the closed caption display controller 23 controls the closed caption video 20 generator 24 by selecting the show or hide state of a closed caption in accordance with at least one of four rules:

"Rule 1: display a closed caption when the speech signal is silent or is it is in less than a given 25 level"

"Rule 2: display a closed caption when the speech signal is in less than a reference level determined in

accordance with the ambient noise level"

"Rule 3: display a closed caption when the ambient noise level is in not less than the given level"

5 "Rule 10: display a closed caption when screen display is multi-screen section display of a plurality of windows and no speech output is selected for the windows"

If a plurality of rules are utilized, the non-display state is selected when all the rules represent the
10 non-display state.

When the rules 2 and 3 are not applied, the ambient noise detector 14 can be omitted. When the rules 1 and 2 are not executed, the speech playback state detector 12 can be omitted.

15 For example, when the playback sound volume of the television is turned down, it is difficult to hear and understand the contents of a talk though a laughing voice or the like can be heard. Also, when ambient noise becomes loud, e.g., the telephone starts ringing,
20 it becomes difficult to hear the speech of the television. However, the speech of the television can be heard even in a noisy environment by turning up the sound volume of the television. The sound volume may be determined from a speech signal, or control
25 information of the television or the like.

When contents are displayed on two or more windows upon reception of the contents from a plurality of

broadcasting stations, it is difficult to simultaneously output speech sounds corresponding to these windows and hear them. In this case, subtitles corresponding to the respective windows are preferably
5 displayed as shown in FIG. 13A. In general, each screen section is selected to output its speech without outputting sounds corresponding to the remaining screen sections. The screen sections other than the screen section selected to output the speech may display
10 corresponding subtitles, as shown in FIG. 13B.

According to the fourth embodiment, a closed caption can be automatically displayed in such situation in which it is hard to hear speech, allowing the viewer to understand the contents.

15 The rules 1 to 3 and 10 define conditions to display a closed caption. A closed caption is displayed when even one of the conditions is satisfied, and is not displayed when no condition is satisfied. To the contrary, the rules may define conditions not to
20 display a closed caption. A closed caption is not displayed when all the conditions are satisfied, and is displayed when even one condition is not satisfied.

These rules and functions are merely an example, and can be variously changed. All (or some) of the
25 above-mentioned functions may be employed to allow the viewer to arbitrarily set which of the functions is to be used. The above functions can also be implemented

by writing them as software and processing them by a computer having a proper mechanism.

5 The above embodiments can also be executed as a program for causing a computer to execute a predetermined means, function as a predetermined means, or implement a predetermined function. In addition, the embodiments can be practiced as a computer-readable recording medium that records the program.

10 The present invention can control display of closed caption character information in accordance with the viewing situation.

15 Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

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